

## **TITLE: NATIONAL BIOTOXINS ANALYTICAL RESPONSE CAPABILITY**

**MILESTONE SHC 2.5.1:** Provide one forecast on the occurrence, distribution, and frequency of a harmful algal bloom in the U.S. and develop capability to provide future forecasts.

**CCEHBR SCIENTISTS/INVESTIGATORS:** Frances Van Dolah (PI); Tod Leighfield (AR Coordinator); Mark Busman, Lorraine Creel, Gregory Doucette, Peter Moeller, Steve Morton, John Ramsdell (AR Team); Ashley Anderson, Stacie Dover, Wesley Jackson

**EXTERNAL COLLABORATORS:** NMFS Office of Protected Species, Florida Marine Research Institute, U.S. Army Medical Research Institute, U.S. Food and Drug Administration

**OBJECTIVES OF RESEARCH ACTIVITIES:** To provide rapid and accurate identification and quantification of marine algal toxins in suspected harmful algal blooms, marine animal mortality events, and human poisonings.

**DESCRIPTION OF RESEARCH ACTIVITIES:** Marine algal toxins have often been suspected in mass mortality events involving fish, marine mammals, and birds. However, confirmation of an algal toxin as the causative agent in these events has traditionally been difficult, due to the non-specific symptoms and pathology associated with toxin induced morbidity and mortality, the complexity of toxin detection, and undefined effect levels of these toxins on impacted species.

The Marine Biotoxins Analytical Response Team was established to provide a formal framework through which to respond to requests for assistance. A two-tiered approach is employed for toxin detection: first, rapid assays are performed for specific toxin classes suspected to be involved, then instrumental analysis is used to provide unequivocal chemical identification of the toxin present. The use of a two-tiered approach allows us to respond to our requestor with preliminary information quickly, which often guides them in their further response to the event. However, chemical confirmation of toxin identity is critical for establishing causal linkages.

### **Selected Highlights from FY02**

Marine Mammals Mortalities Major events responded to during FY02 include extensive mortalities of marine mammals that began in February and continued through June 2002. The event began with the mysterious deaths of along the California coast from San Luis Obispo to Orange County. Analysis of dolphin urine by the ART revealed high concentrations of the algal toxin, domoic acid (DA). Blooms of the DA-producing diatom, *Pseudo-nitzschia australis*, were subsequently found to be the source of toxicity and these blooms continued intermittently on the California coast through June, resulting in the deaths of large numbers of dolphins, sea lions, sea otters and whales. Over 100 samples were analyzed by the ART to confirm the involvement of DA. DA was identified by this program as the causative agent in the mass mortality of California sea lions in the Monterey Bay area in 1998 and of California sea lions and sea otters in 2000. This is the first year in which multiple species were severely impacted from San Francisco south to Los Angeles.

**Human Fatalities** A meal of a commonly eaten red alga "kulot" in April 2002 resulted in the severe poisoning of twelve members of an extended family, including fatalities of three young men, in the northern Philippine town of Bulinao. This is a region of historically pristine waters that have begun to experience unprecedented algal blooms and fish kills following the introduction of fish farming. Kulot has not previously been involved in human poisonings. The ART received a request for assistance by Dr. Lourdes Cruz, of the University of the Philippines, whose laboratory was tasked by the Philippine government to identify on the causative agent in the poisoning. Dr. Cruz traveled to CCEHBR to work with Marine Biotoxins Program scientists to identify the toxin present in algal extracts. The ART carried out a suite of analyses for suspect algal toxins associated with HABs and macroalgae that were consistent with the symptoms of the victims. A neuroexcitatory toxin was found which differs from the suite of toxins usually associated with harmful algal blooms. A collaboration established with a Japanese research group confirmed that the toxin was not polycavernoside, a toxin from a red alga that caused human fatalities in Guam some twenty years ago. The precise determination of toxin identity is currently underway as a collaborative effort of these research groups.



**L. to R.:** Lourdes Cruz, U. Philippines, Fran VanDolah, Tina Mikulski, Yinglin Zou, Ist Institute of Oceanography, China, working on red algae extracts.



Tod Leighfield and Loranne Creel performing DA receptor assays on samples from the 2002 California marine mammal mortality event.

Additional events responded to in FY2002:

Date	Event	Suspected Toxin	Customer
May 2002	pufferfish, clams, dolphins IRL, FL	PSP	FDA, FL MRI
July 2002	Hawaiian monk seals	CTX	NMFS, Honolulu
Sept 2002	oysters from Mexico	DA	Shellfish Sanitation Pgm, MX

**Publications/Reports:**

Van Dolah, F.M., Doucette, G.J., Gulland, F., Bossart, G., Rowles, T. (in press) Impacts of Algal Toxins on Marine Mammals. In, Toxicology of Marine Mammals. (Vos, J., Bossart, G.D., Fournier, M., O'shea, T., Eds.) Taylor and Francis, New York, N.Y.

Leighfield, T., Van Dolah, F., Doucette, G., Moeller, P., Morton, S. Creel, L., Busman, M. and Ramsdell, J. 2002. NOAA's Marine Biotoxin Analytical Response Team. Tenth International Conference on Harmful Algae, St. Petersburg, FL, October 21-15, 2002. (Poster Presentation)

**Presentations:**

Van Dolah, F.M. Report on Marine Biotoxin Involvement in the California and Florida Panhandle Mortality Events. Annual Meeting of the NMFS Marine Mammal Unusual Mortality Event Working Group, Silver Spring, MD, March 11-13, 2002